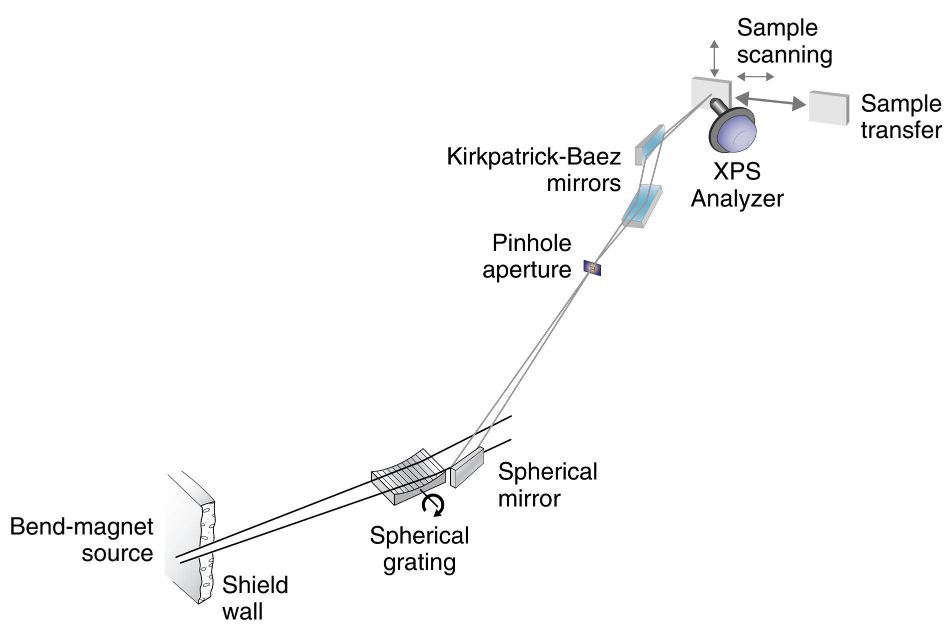
X-Ray Photoelectron Microscopy (microXPS) • Branchline 7.3.1.2

Berkeley Lab • University of California

Branchline Specifications

Photon Energy Range (eV)	Photon Flux (photons/s/0.1%BW)	Spectral Resolution (E/ΔE)	Spatial Resolution (μm)	Samples	Availability
175–1500	1×10^{10} (at 800 eV)	1800 (at 800 eV)	1×1 (scanning XPS imaging)	UHV-Compatible Solids (≤ 50 × 50 mm)	NOW



Schematic layout of Branchline 7.3.1.2.

Beamline 7.3.1 has two branches co-developed with industrial partners. The spatially resolved x-ray photoemission station (microXPS) on Branchline 7.3.1.2 was developed with the Intel Corporation and the Applied Materials Corporation. It is designed specifically for analyzing the microstructures (including interfaces) in integrated circuits (ICs) and the silicon wafers from which ICs are made. A separate data sheet describes Branchline 7.3.1.1 with an x-ray photoemission electron microscope (X-PEEM).

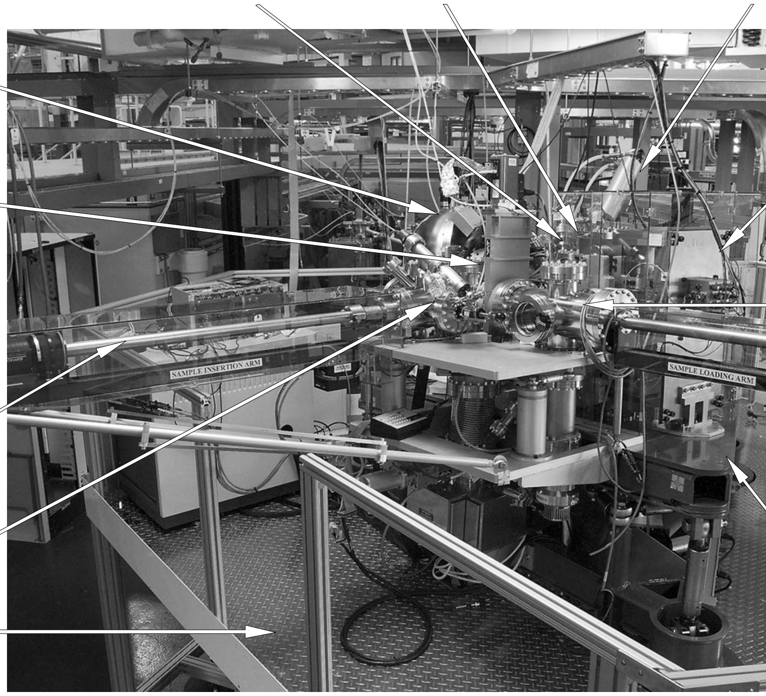
Beamline 7.3.1 operates over the photon energy range from 175 to 1500 eV with a spectral resolving power of 1800, which is adequate for most imaging investigations. A spherical-grating monochromator (SGM) with no entrance slit and a low line-density grating (200 lines/mm) is used to obtain high throughput while still achieving the desired spectral resolution. The radiation source is the center magnet in the triple-bend achromat lattice of the ALS storage ring. A small horizontal aperture scrapes off only a portion (about 0.2 mrad) of the

7/00

2.2-mrad-wide fan from Beamline 7.3.1 and directs it to the microXPS branch without significantly reducing the flux delivered to the X-PEEM branch.

A pair of elliptically bent mirrors (in a Kirk-patrick-Baez arrangement) focuses light from the monochromator exit aperture to a spot size of about 1 μm^2 while maintaining a photon flux of 1×10^{10} photons/s. Sample handling capabilities allow researchers to load, prepare, and transfer samples from a load-lock chamber at atmospheric pressure, through a preparation chamber at high vacuum, and into the analysis chamber at ultrahigh vacuum. The system can handle wafers up to 50 mm $\times$ 50 mm on a high-precision x-y stage. With a laser-interferometry positioning system, the samples can be positioned with < 0.1-μm precision. Using an *in-situ* optical microscope, fiducials written on the wafer sample can be positioned with 1-μm accuracy.

MicroXPS can be used for a variety of tasks in which the surface chemistry of microstructures needs to be determined, such as investigating device-failure mechanisms in next-generation computer chips or identifying microscopic surface contaminants that can result in failure of multilevel chip structure. ■



***The microXPS station** sits atop a high-stability tetrahedral support structure that is surrounded by a "people platform" for access to the sample chamber and high-precision x-y sample manipulator. In addition to microXPS with synchrotron radiation, the station incorporates sample-preparation facilities and sample-positioning tools.*

This branchline is available to independent investigators by submitting a proposal.

For Branchline Information

Glenn Ackerman
Advanced Light Source
Berkeley Lab, MS 80-100
Berkeley, CA 94720
Tel: (510) 486-7886
Fax: (510) 486-7696
Email: gdackerman@lbl.gov

PRT Spokesperson

Harry Fujimoto
Intel Corporation, SCI-3
3065 Bowers Avenue
Santa Clara, CA 95052
Tel: (408) 765-2069
Fax: (408) 765-2940
Email: harry.h.fujimoto@intel.com

To Obtain a Proposal Form

Bernie Dixon
User Services Office Manager
Advanced Light Source
Berkeley Lab, MS 6-2100
Berkeley, CA 94720
Tel: (510) 486-6722
Fax: (510) 486-4773
Email: alsuser@lbl.gov

Berkeley Lab
7/00